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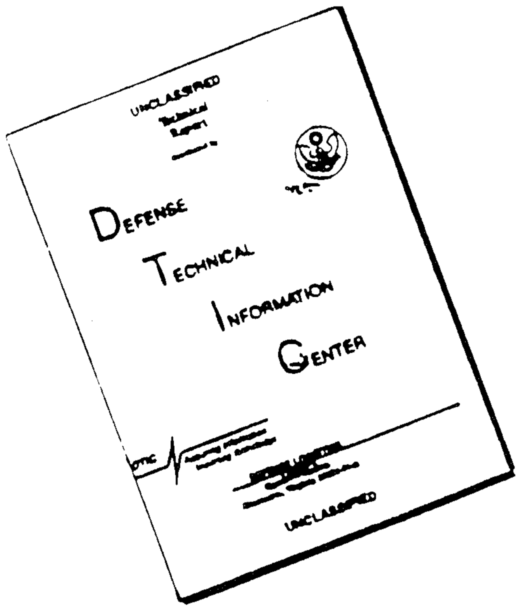

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26 February 1996

Final Report for Grant #N00014-95-1-0235
Principal Investigator: Nan Bray
Expiration Date: 11/30/95

Summary

This grant covered the cost of acquiring a complete towed ADCP/CTD system, assembling it and doing preliminary tests. The system has subsequently been used very successfully as part of the ONR-funded program "A Towed Acoustic Doppler Current Profiler System," to collect upper ocean profiles of current in the data-scarce eastern Indonesian Archipelago. A cruise report is appended. The system was designed particularly for use on foreign research vessels not equipped with hull-mounted ADCPs nor underway CTD profiling capability.

Description of the equipment

We purchased the towed body from ENDECO: their V-Fin CPV. Specially-faired 7-conductor cable and a shock-absorbing bungee cord were also purchased from ENDECO. We had to modify the shock-cord, as the one we purchased failed after 3 days of towing at a speed of 10 kt. The modifications allow for multiple wraps of the shock cord, while distributing the load evenly over all wraps. Otherwise, the fish and cable worked very well, without any major modifications.

The ADCP is a 153-kH broadband system purchased from RDI. We purchased from RDI the required 90 degree angle to orient the transducer head down, while leaving the pressure case in a horizontal position, as required for mounting it in the fish. The RDI system functioned well on both the test cruise and the science cruise.

We purchased an Ocean Sensors CTD OS200 to mount inside the towed fish. This CTD is a small, internally-recording instrument. It is not as inherently accurate as the larger systems like SeaBird and NBIS, but has the great advantage of being small enough to fit easily inside the fish and not change the dynamic balance of the towed body. The OS CTD worked well on both the test cruise and science cruise.

Ancillary equipment purchased on this grant included redundant GPS navigation systems from Garmin, three portable PCs to log the data, electronic test equipment, and a large hard drive for data storage. The entire package works very well as a system. It will be used by Dr. Andreas Munchow (Rutgers University) in June of this year, and again in early 1997 for a repeat survey in eastern Indonesia.

Attachment: Cruise Report (SP95)

Cruise Report

ARLINDO Phase II Shallow Pressure Array Deployment/ADCP (SP 95)

R/V *Baruna Jaya*

Kupang to Jakarta

4-18 December 1995

Nancy A. Bray
Susan Hautala

University of California, San Diego
Scripps Institution of Oceanography
Center for Coastal Studies, 0209
9500 Gilman Drive
La Jolla, California 92093-0209

The cruise had two objectives: to deploy 8 shallow-pressure gauges at various sites in Nusa Tenggara and to conduct towed ADCP/CTD surveys between those sites. Both of the objectives were met. The ship functioned well, the instrumentation worked correctly, and the crew were most helpful in accomplishing the tasks. The shallow pressure sites are listed in Table 1. ADCP surveys are listed in Table 2. The cruise track is sketched in Figure 1.

The SP95 cruise leg began in Kupang on the 3rd of December, immediately following the second JADE95 cruise. [The two pressure sensors in Ombai Strait (Figure 2) were deployed on that leg; no ADCP transects were done]. From Kupang, we steamed to Roti and conducted four ADCP transits of Timor Passage. On the morning of the 6th, we surveyed and deployed the shallow-pressure gauge for Roti on the small island of Ndao (Figure 3). We then transited to the south of Sumba Island, running the ADCP most of the way. The last third of the transit does not have ADCP data because of a mechanical problem with the cable, which was fixed the next day. On the 7th we surveyed, and on the 8th we deployed the gauge at S. Sumba (Figure 4). That night we transited along the north side of Sumba, and the morning of the 9th surveyed and deployed the pressure sensor on the north side of Sumba (south side of Sumba Strait--Figure 5). That night we ran the ADCP across Sumba Strait and across Sape Strait. The morning of the 10th we surveyed and deployed the sensor on the south side of Sumbawa (north side of Sumba Strait--Figure 6). That night we crossed Sumba Strait twice more, running the ADCP, and then steamed for Lombok. Because of heavy wind and swell on the Indian Ocean side of the islands, we steamed north through Selat Alas, and along the north side of Lombok to the pressure sensor site off Gili Trewangan (Figure 7). The Lombok gauge was surveyed and deployed on the morning of the 12th. We then steamed across Lombok Strait (no ADCP) and surveyed the Bali gauge site that same afternoon. That night we did 6 ADCP transits of Lombok Strait, on a line connecting the two pressure sensor locations. The morning of the 13th we deployed the Bali gauge (Figure 8). We then ran 2 ADCP transits of Lombok Strait, intending to do 6 transits. However, bad weather (30-

knot winds from the NW) terminated the work. We pulled the ADCP out of the water at 1900 CIT and began steaming to port.

Although the ADCP and CTD data are preliminary, and will require calibration and further processing, a general pattern of near-surface circulation is evident. The flow in most of the passages was from the Indian Ocean into the interior seas in the top 100 m of the water column. The only exception was in the center of Timor Passage, where the flow was into the Indian Ocean. From Roti to Sumba and across Sumba Strait, the flow was strongly east and northward. Flow through Selats Sape, Alas, and Lombok was northward, reaching a velocity of 1.5 m s^{-1} in Lombok. Along the south coast of Sumbawa, the flow was eastward at about 1 m s^{-1}. Below about 100 m the flow was westward or northward in the passages: that is, in the direction expected for the throughflow. In Lombok Strait, during the first set of 6 transits, flow at the surface was 1.5 m s^{-1} to the northeast, while flow at 150-m depth was 1 m s^{-1} to the southwest, corresponding to 5 knots of shear over the top 150 m. In general, the water properties from the towed CTD are consistent with the following interpretation of the velocity data. It appears that the S. Java Current occupies the top 100 m or so of the water column and is quite well-developed along the south coast of Java, Bali, Lombok, Sumbawa, and possibly even Sumba. It is characterized by velocities of 1 m s^{-1}, salinity around 33.5 and temperature of 28.7. Below that relatively less dense current, the throughflow was still flowing toward the Indian Ocean. The S. Java Current flows northward through all the interisland passages we observed, and strongly eastward through Sumba. This circulation pattern has not been observed previously. In Timor Passage, throughflow occupied the middle section of the passage, while relatively warm, saline Indian Ocean water appeared near the surface on the south end of the transect.

The data from the pressure gauges will be recovered in about a year. The original ADCP and CTD data are with Dr. Gani Ilahude.

Table 1. Pressure Gauge Locations

Date	Location	Latitude	Longitude
29 Nov	S. Ombai	8 39.848 S	125 06.614 E
30 Nov	N. Ombai	8 21.041 S	125 04.415 E
06 Dec	Dao (Roti)	10 49.04 S	122 41.07 E (Ship pos: radar 240@0.24 nm)
08 Dec	S. Sumba	10 15.29 S	120 31.40 E (Ship pos: radar 279@0.65 nm)
09 Dec	N. Sumba	9 22.925 S	119 12.219 E
10 Dec	SE Sumbawa	8 47.704 S	118 57.025 E
12 Dec	Lombok	8 20.263 S	116 2.286 E
13 Dec	Bali	8 24.155 S	115 42.602 E

Table 2. ADCP Surveys

Dates	Location
4-6 Dec	Timor Passage
6-7 Dec	Roti-Savu-Sumba
8-9 Dec	S Sumba-N Sumba
9-10 Dec	Selat Sumba/ Selat Sape
10-11 Dec	Selat Sumba
11-12 Dec	Transit to Lombok/ Selat Alas
12-13 Dec	Selat Lombok

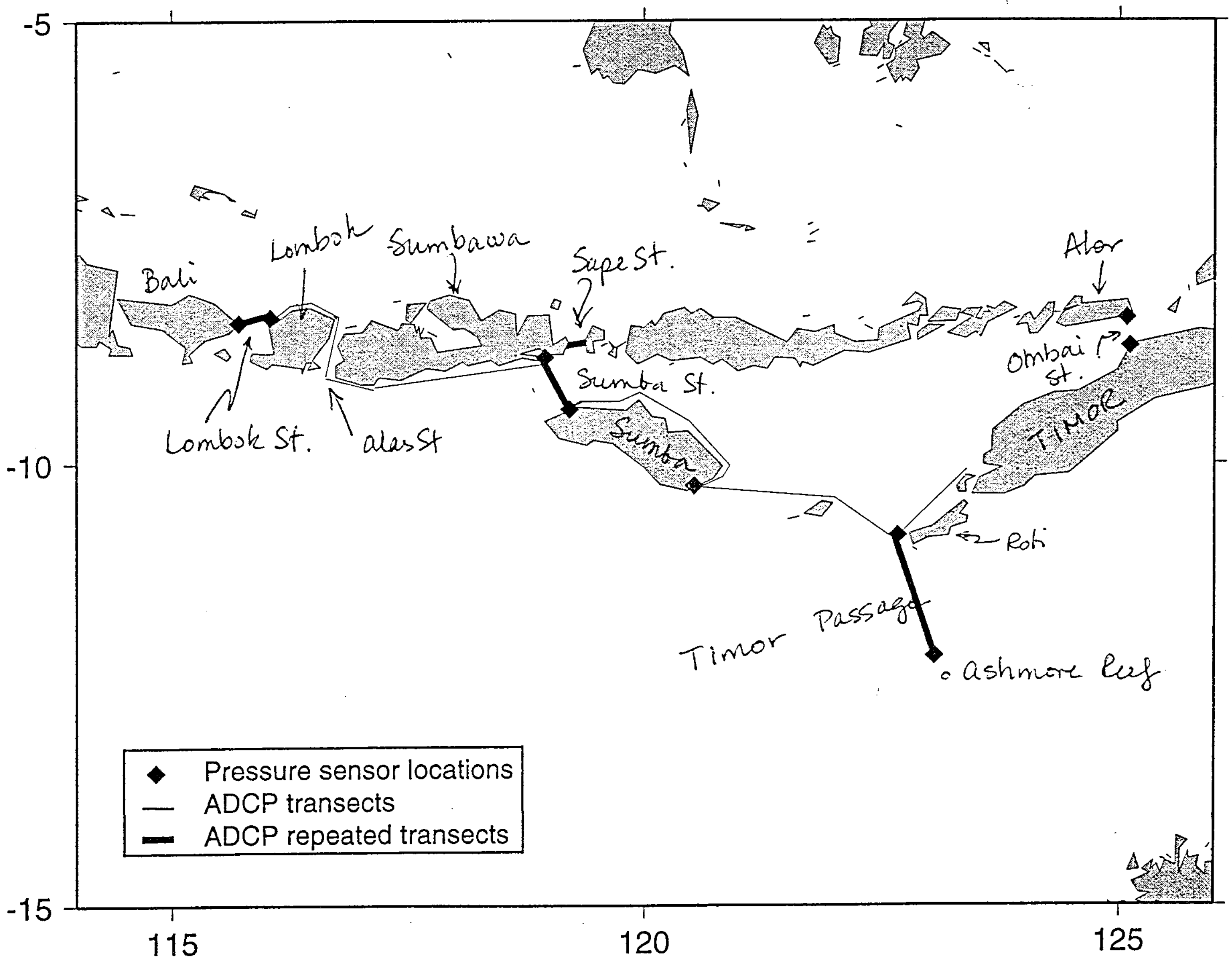
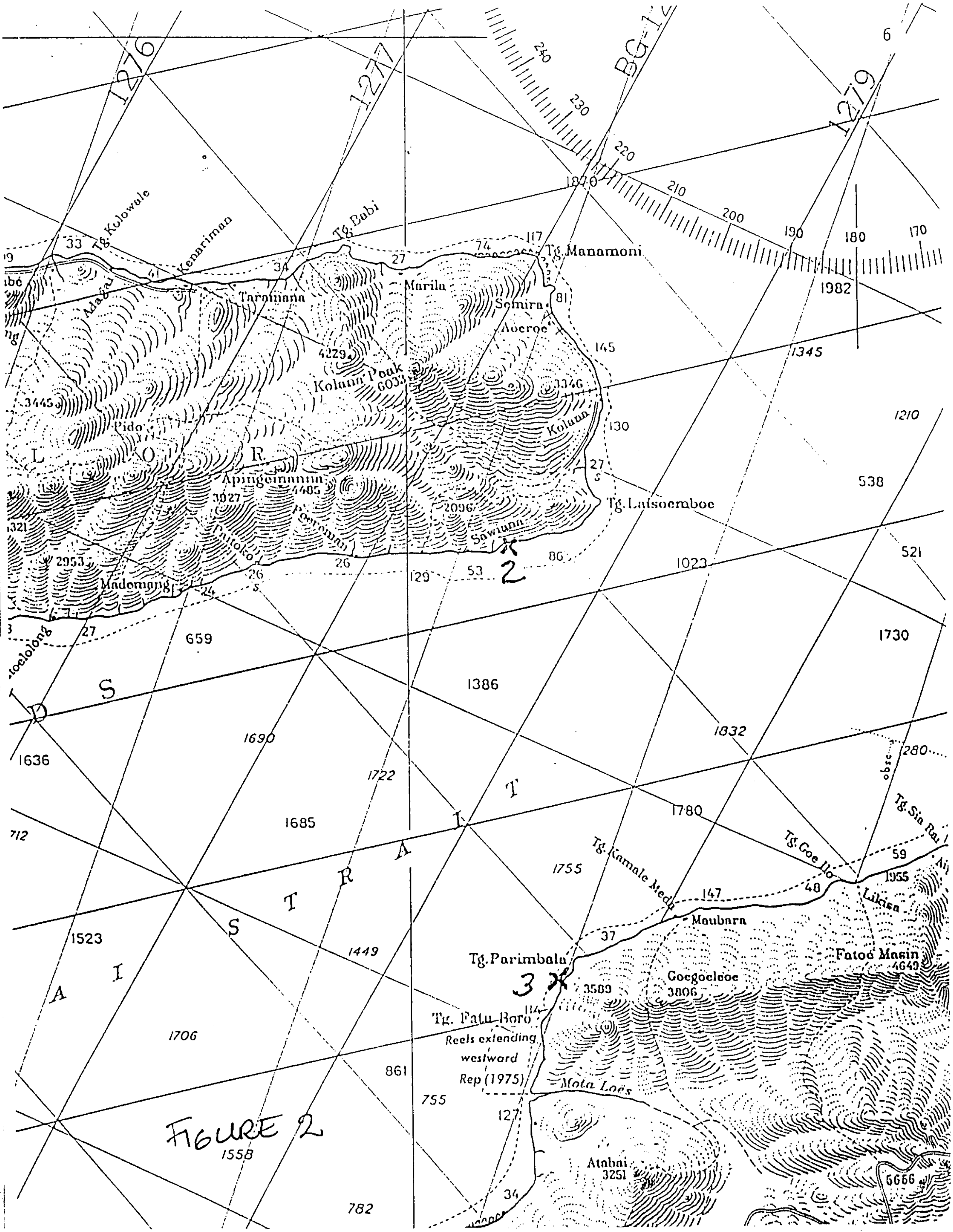


Figure 1. Cruise track for the Shallow Pressure Cruise


1276
1277
BG-12
1279
240
230
220
210
200
190
180
170
1820
1982
Tg. Kolowule
Kenarimaa
Tg. Babi
Tg. Manamoni
Taramana
Marila
Semira
Aoeroe
Kolana Peak
6033
4229
3346
3445
Pido
Kolana
L O R
Apingemana
4485
3027
2096
Tg. Laisoeraboe
Sawiuna
2953
Madomang
1345
1210
538
521
1023
1730
659
1386
1832
1690
1636
1722
1685
1780
280
Tg. Sia Rai
Tg. Goe Ilo
59
1955
48
Liltisa
Tg. Kamale Meda
147
Maubara
1755
37
Fatoe Masin
4649
Tg. Parimbala
Goegoeloee
3806
3589
Tg. Fatu Boro
Reefs extending westward
Rep (1975)
Mota Loës
Atabai
3251
6666
712
1523
1449
1706
861
755
1558
782
D S
T
S T R A I T
A I
2
3
FIGURE 2

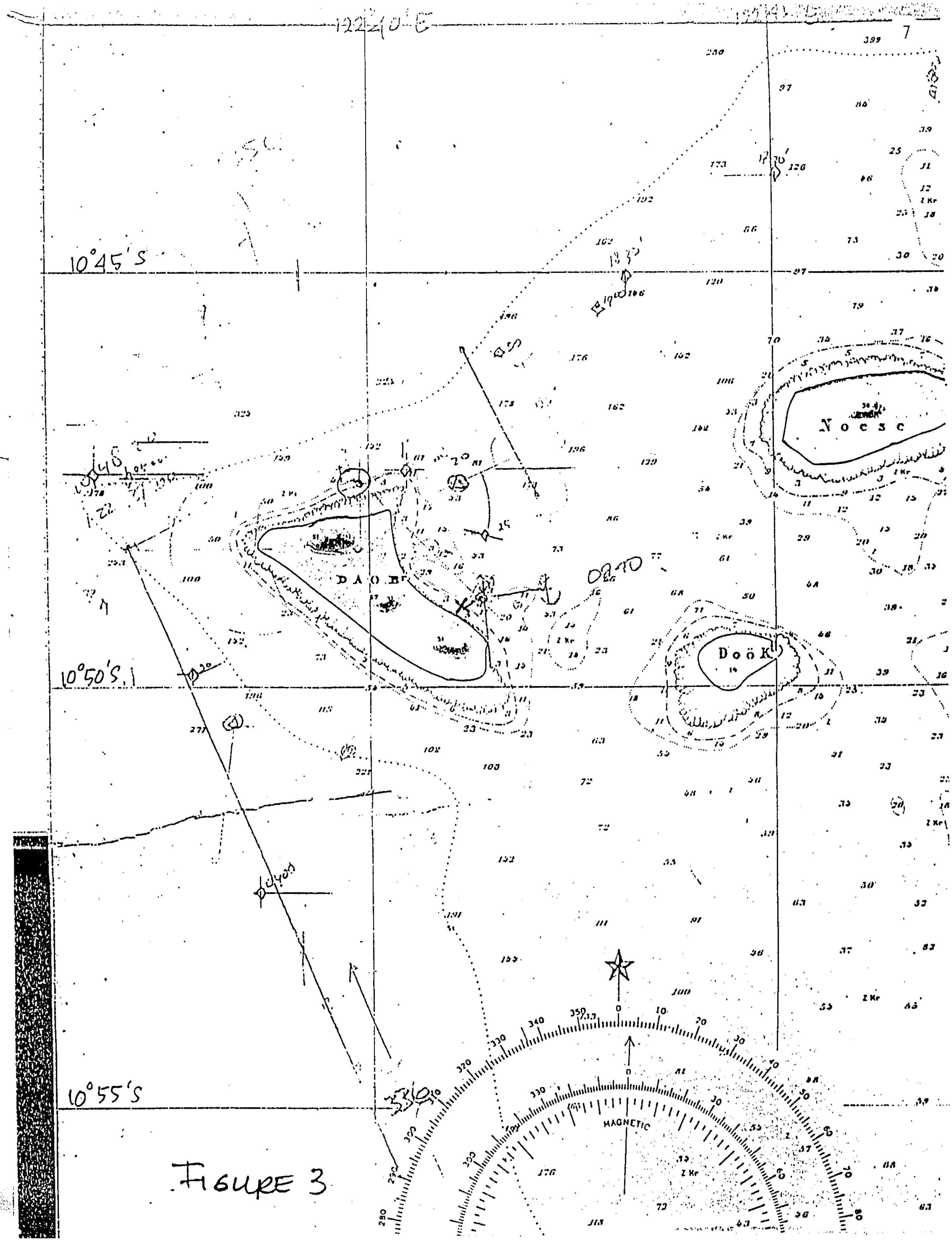


FIGURE 3

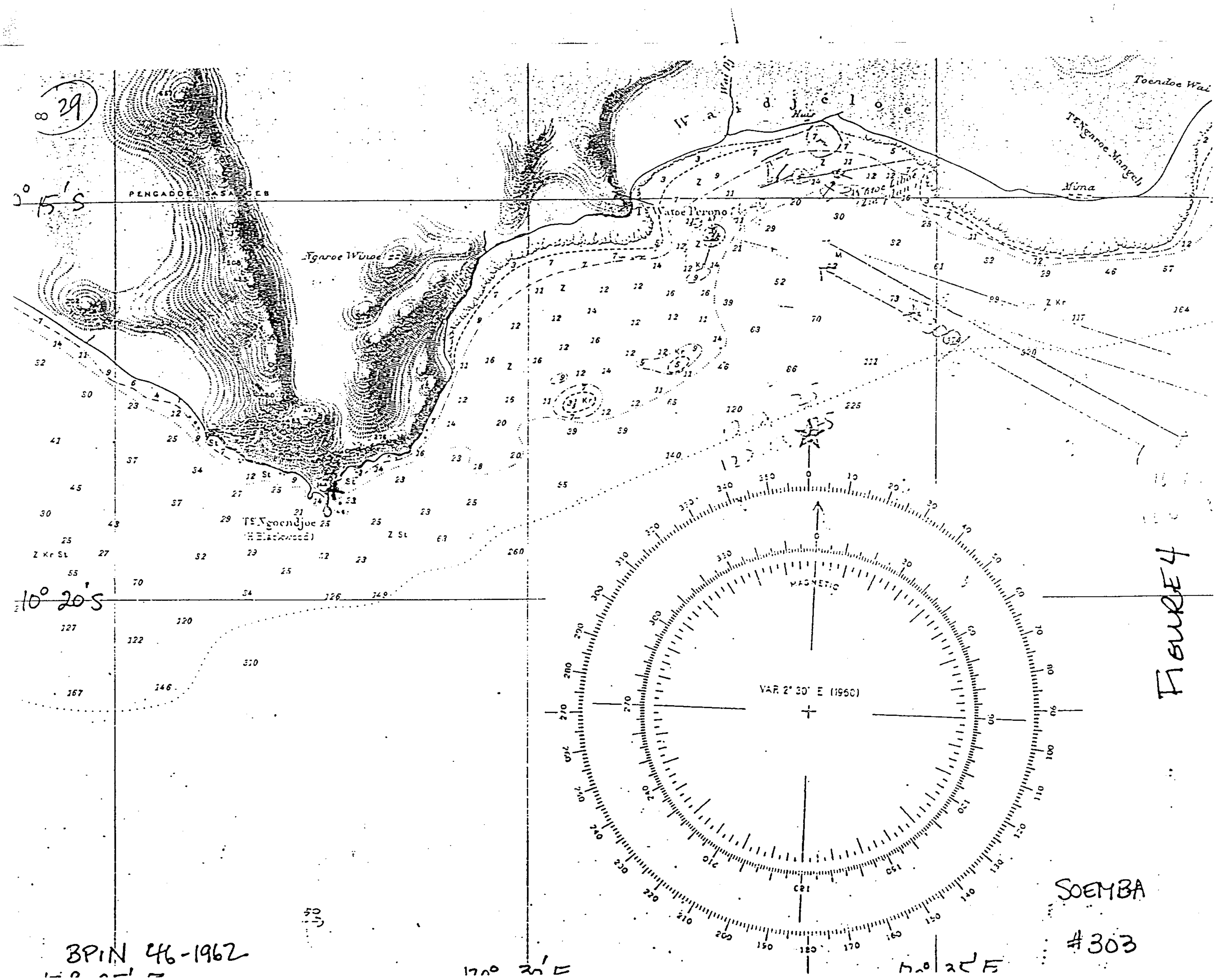
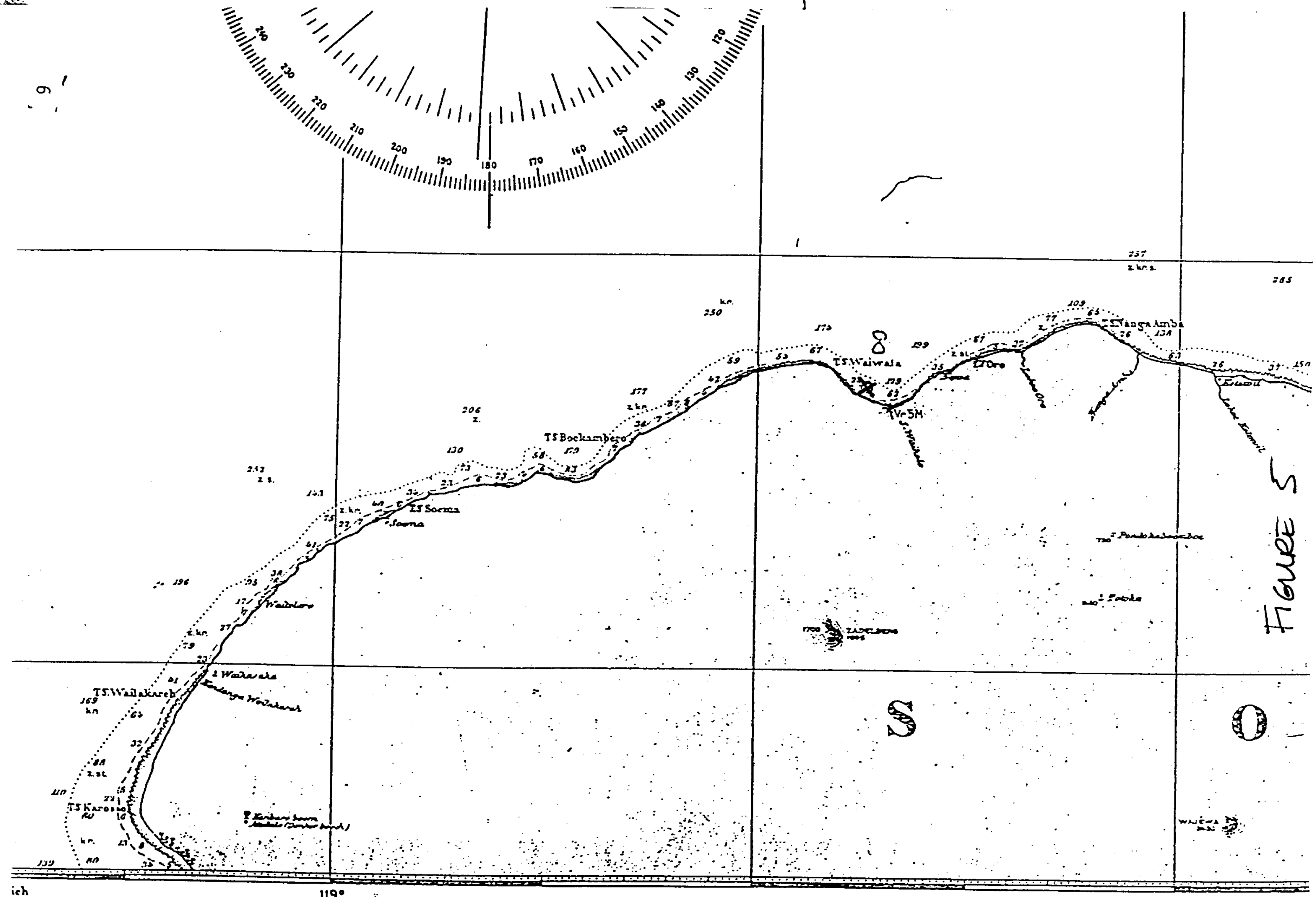

29
PENGADOE SASAPOEB
10° 15' S
10° 20' S
Ngaroe Wiwe
Tg Ngoendjoe
Tg Watoe Perono
W a i d j e l o e
Toendoe Wai
Tg Ngaroe Mangeli
Mina
VAR 2° 30' E (1960)
MAGNETIC
120° 30' E
120° 35' E
BPIN 46-1962
SOEMBA
#303

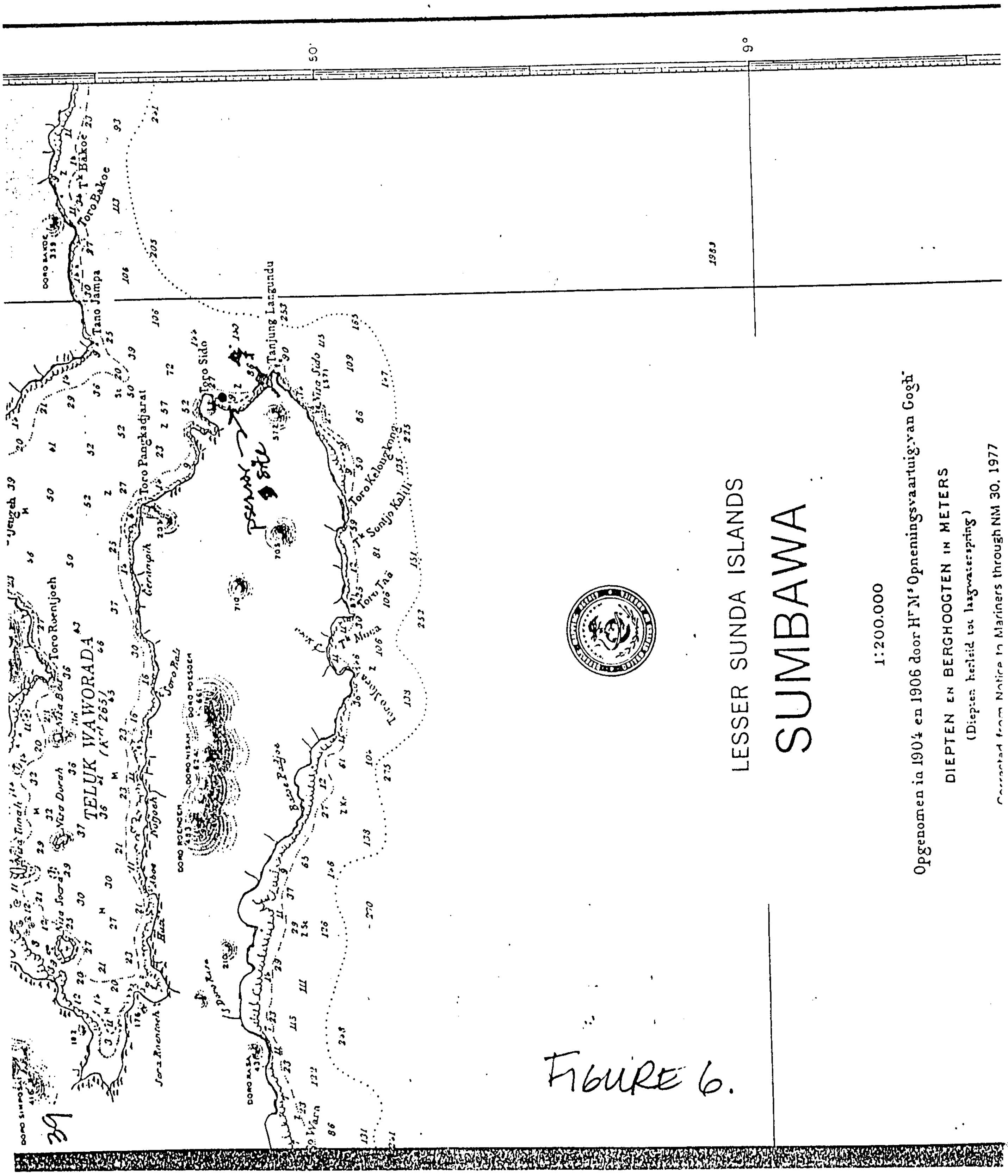
FIGURE 4



Meridiaan van stelling: Batavia (Uitkijk) 106° 48' 37" 0 (OLD)

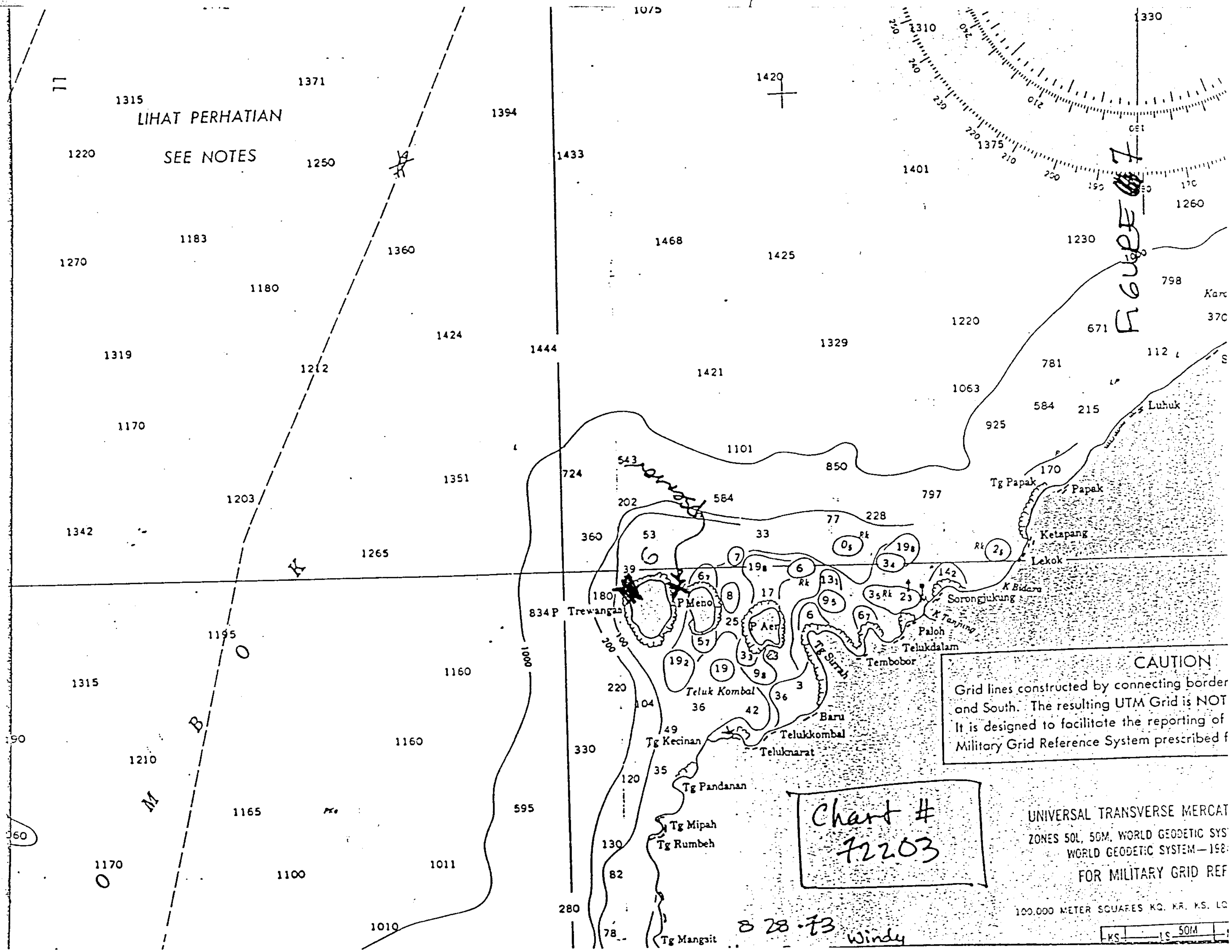
Feb. '44	Aug. '62	Feb. '64	'65-24 April '67

Chart #73041



LESSER SUNDA ISLANDS
SUMBAWA
1:200.000
Opgenomen in 1904 en 1906 door Hr Ms Opnemingsvaartuig van Gogh
DIEPTEN EN BERGHOOGTEN IN METERS
(Diepten herleid tot laagwaterspring)
Corrected from Notice to Mariners through NM 30, 1977
TELUK WAWORADA
Toro Roentjoeh
Toro Pangkadjaral
Toro Sido
Tanjung Langundu
Tano Jampa
Toro Bakoe
Toro Kelongkong
Toro Taa
50'
9°

FIGURE 6.



LIHAT PERHATIAN
SEE NOTES
Tg Papak
Papak
Ketapang
Lekok
K Bidara
Sorongjukung
K Tanjung
Paloh
Telukdalam
Tembobor
Tg Sirrah
Baru
Telukkombal
Teluknarat
Teluk Kombal
P Meno
P Aer
P Trewangan
Tg Kecinan
Tg Pandanan
Tg Mipah
Tg Rumbeh
Tg Mangsit
Luhuk
CAUTION
Grid lines constructed by connecting border
and South. The resulting UTM Grid is NOT
It is designed to facilitate the reporting of
Military Grid Reference System prescribed f
UNIVERSAL TRANSVERSE MERCAT
ZONES 50L, 50M, WORLD GEODETIC SYS
WORLD GEODETIC SYSTEM—19
FOR MILITARY GRID REF
100,000 METER SQUARES KQ. KR, KS. LQ
Chart # 72203
8-28-73 Windy

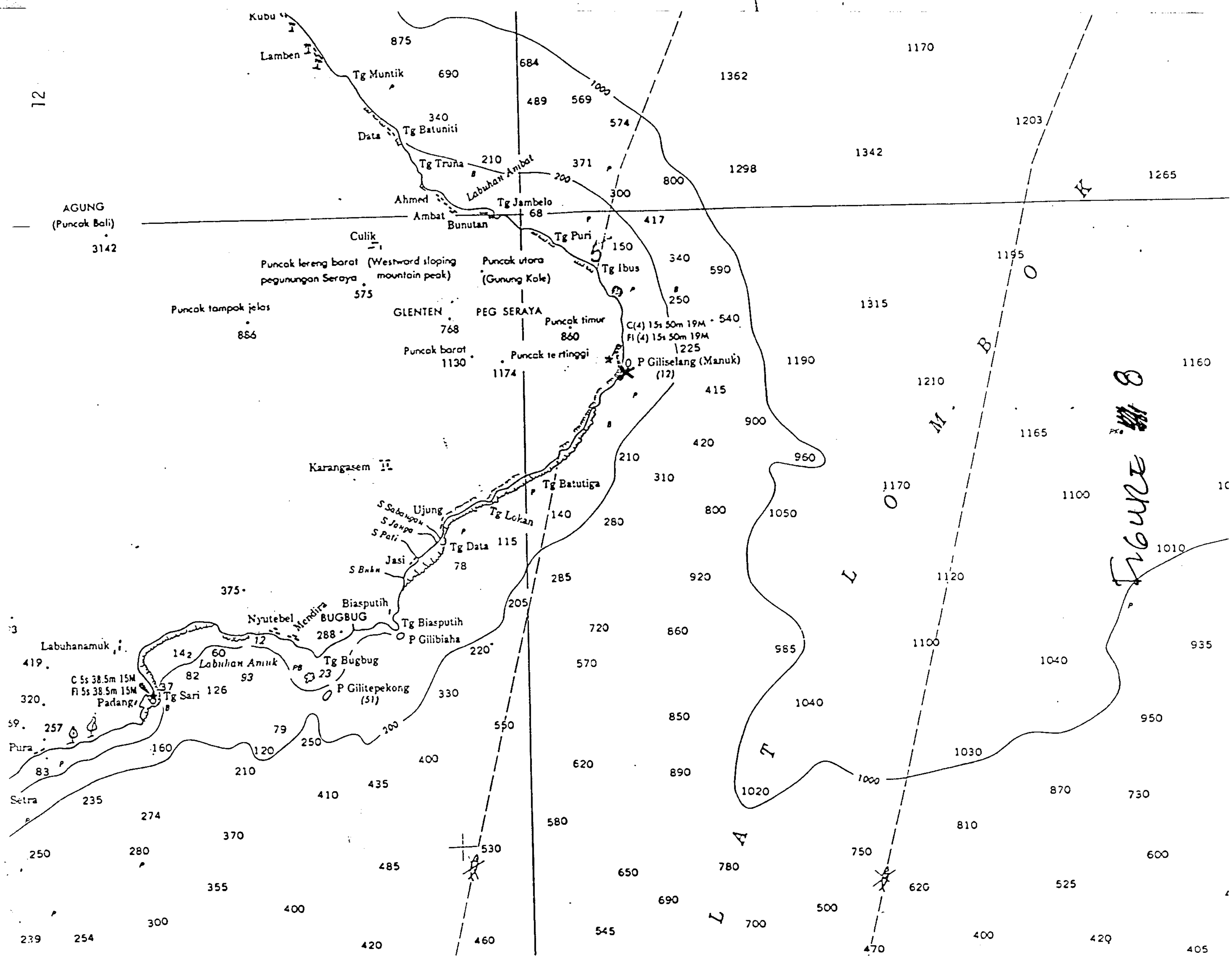


Figure 8
Kubu
Lamben
Tg Muntik
Data
Tg Batuniti
Tg Truna
Labuhan Ambat
Ahmed
Ambat
Bunutan
Tg Jambelo
Tg Puri
Tg Ibus
AGUNG
(Puncak Bali)
3142
Culik
Puncak lereng barat pegunungan Seraya
(Westward sloping mountain peak)
575
Puncak utara
(Gunung Kole)
Puncak tampak jelas
856
GLENTEN
768
PEG SERAYA
Puncak timur
860
Puncak barat
1130
Puncak tertinggi
1174
C(4) 15s 50m 19M
Fl (4) 15s 50m 19M
P Giliselang (Manuk)
(12)
Karangasem
Tg Batutiga
Tg Lokan
Ujung
S Sabawgan
S Jangga
S Pali
S Buhu
Tg Data
Jasi
Biasputih
Nyutebel
Mendira
BUGBUG
Tg Biasputih
P Gilibiaha
Tg Bugbug
P Gilitepekong
(51)
Labuhan Amuk
Labuhanamuk
C 5s 38.5m 15M
Fl 5s 38.5m 15M
Padang
Tg Sari
Pura
Setra
LOMBOK
STRAIT